

004220-6295560

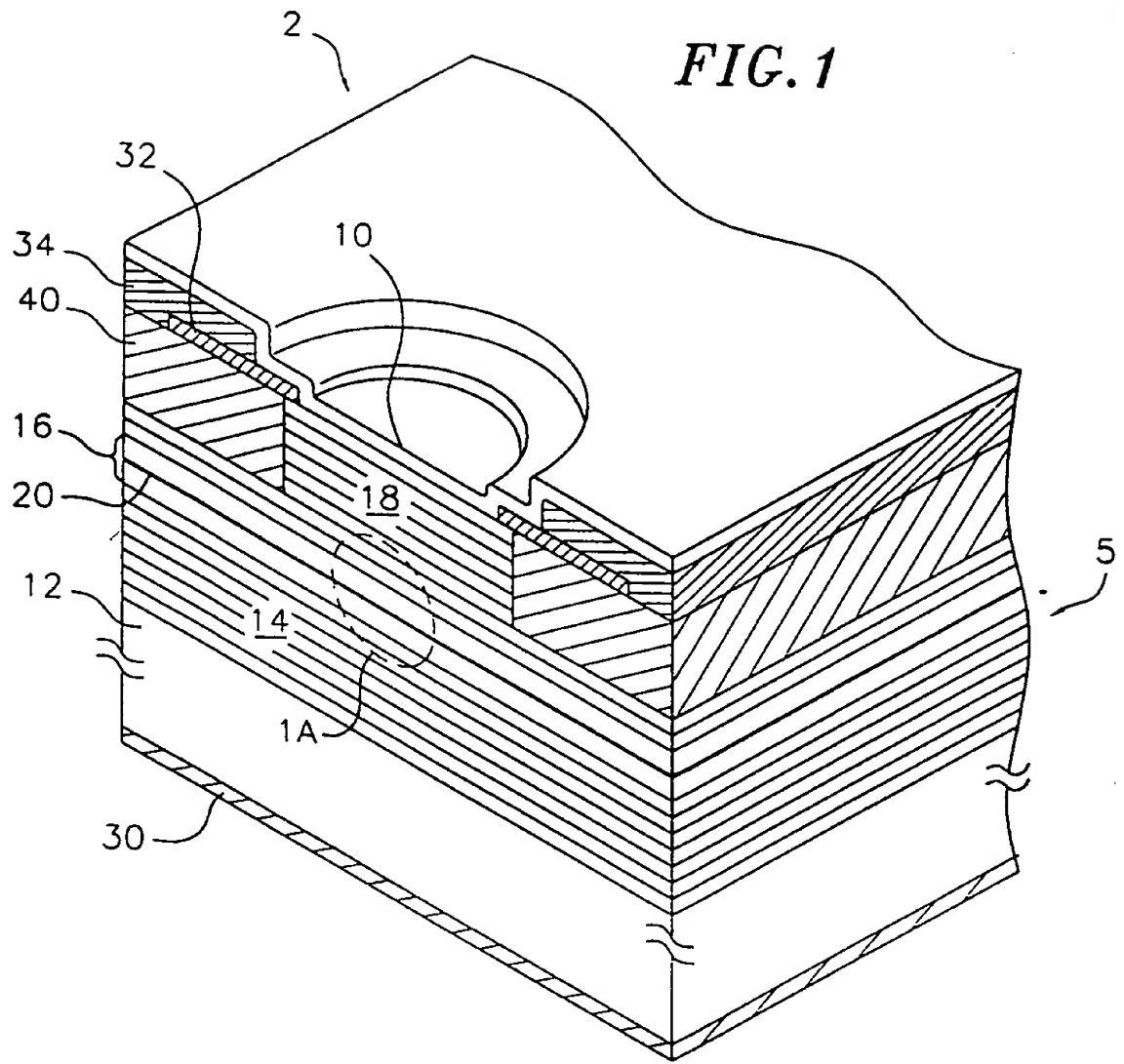


FIG. 1A
PRIOR ART

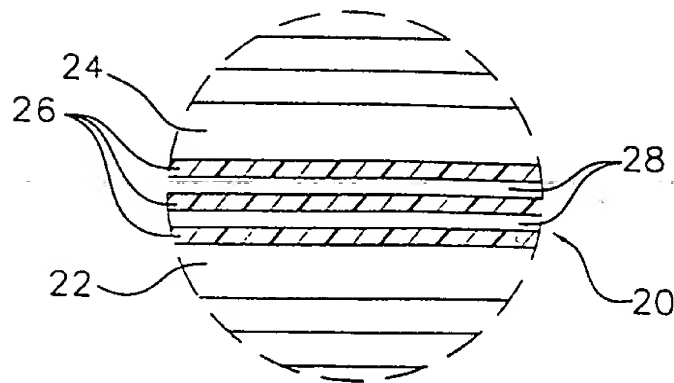
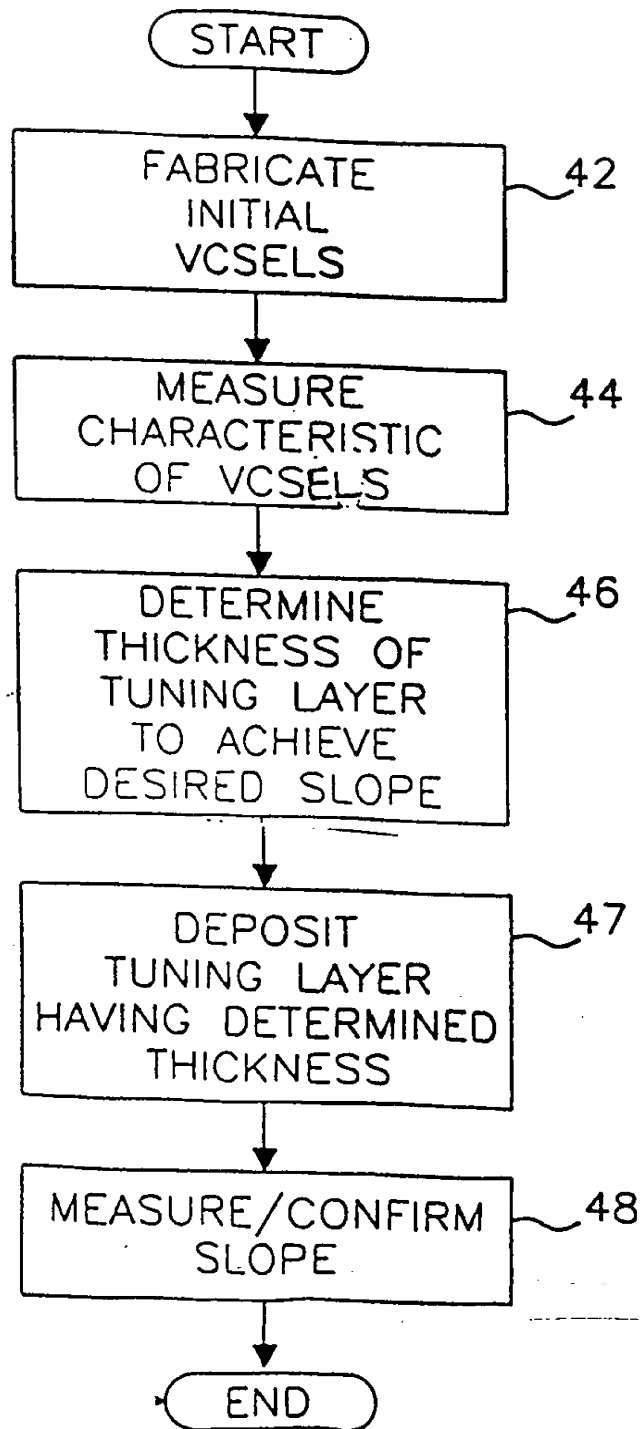


FIG. 2



004250-6295650

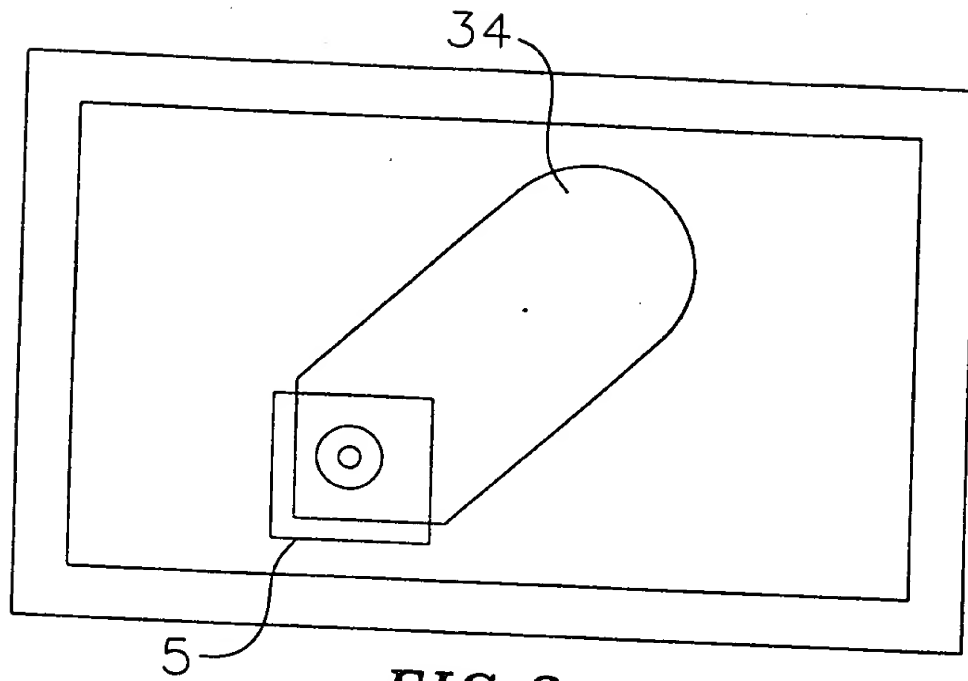


FIG. 3

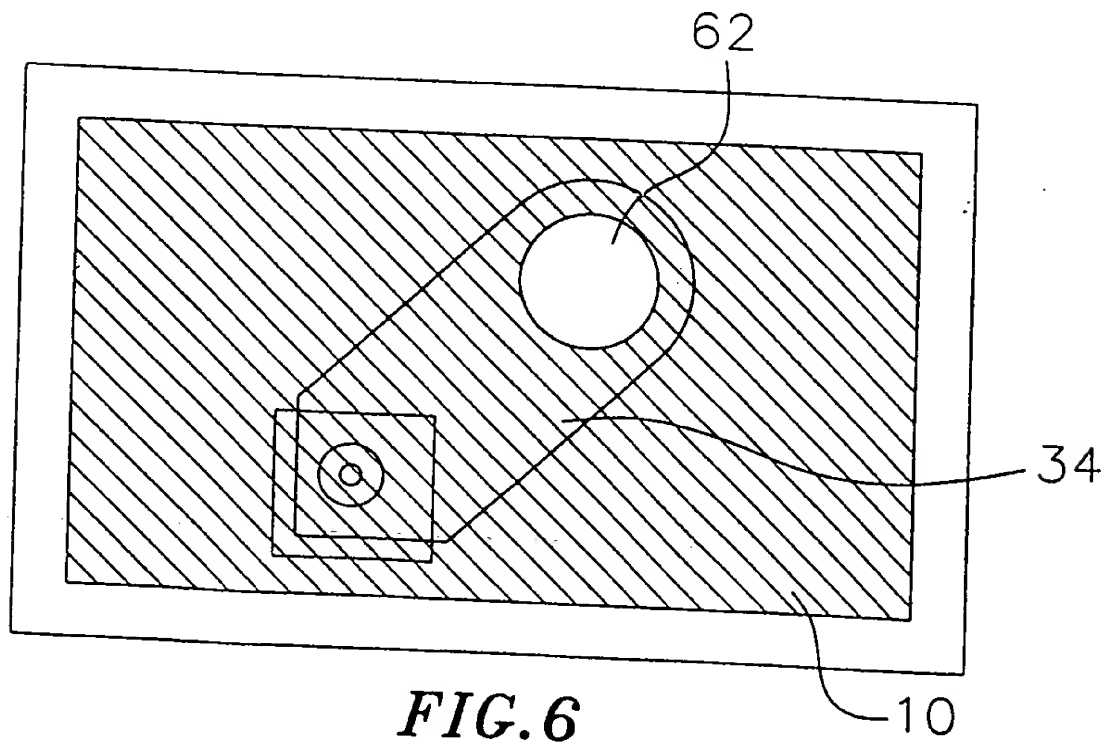


FIG. 6

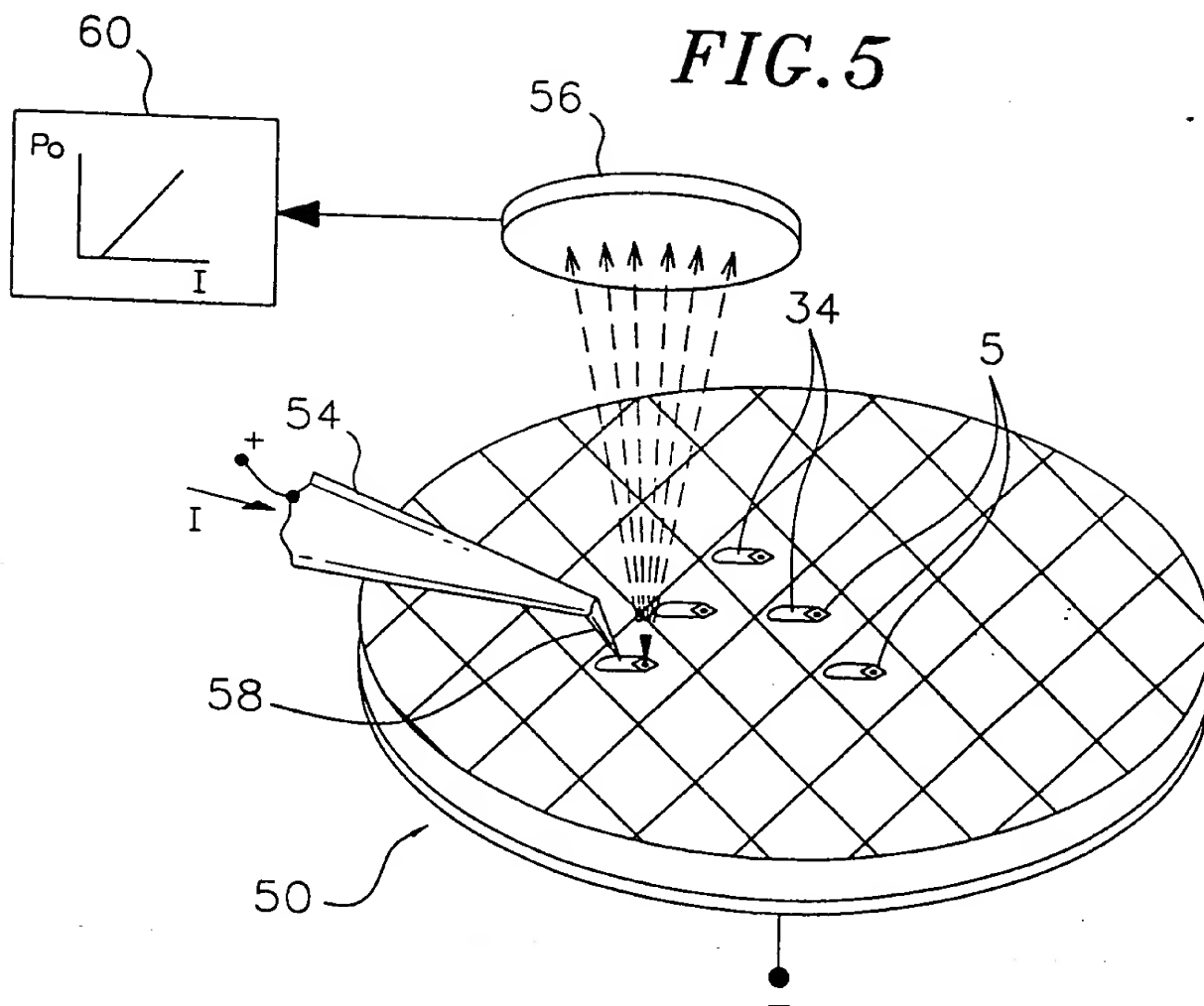


FIG. 4

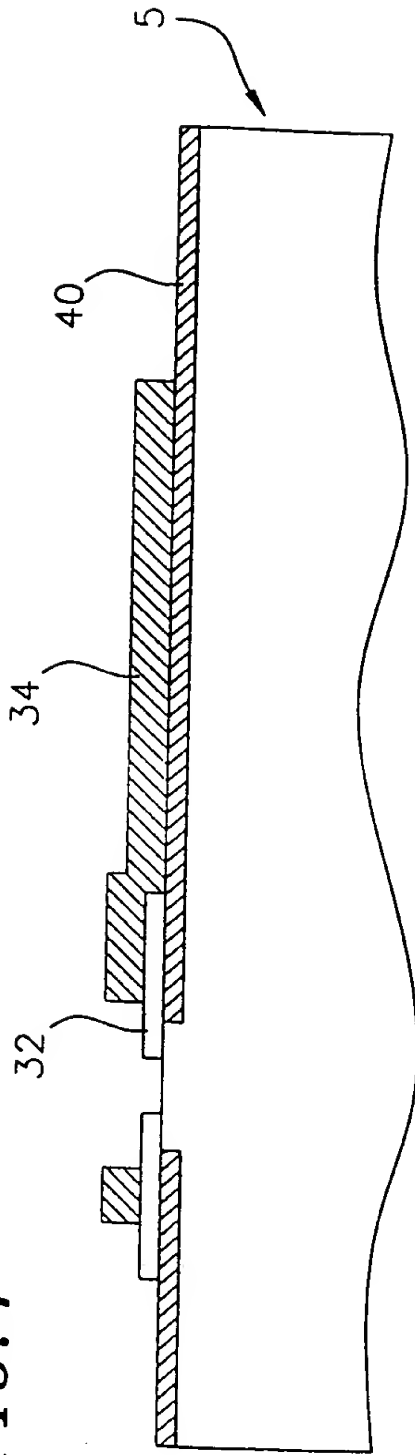


FIG. 7

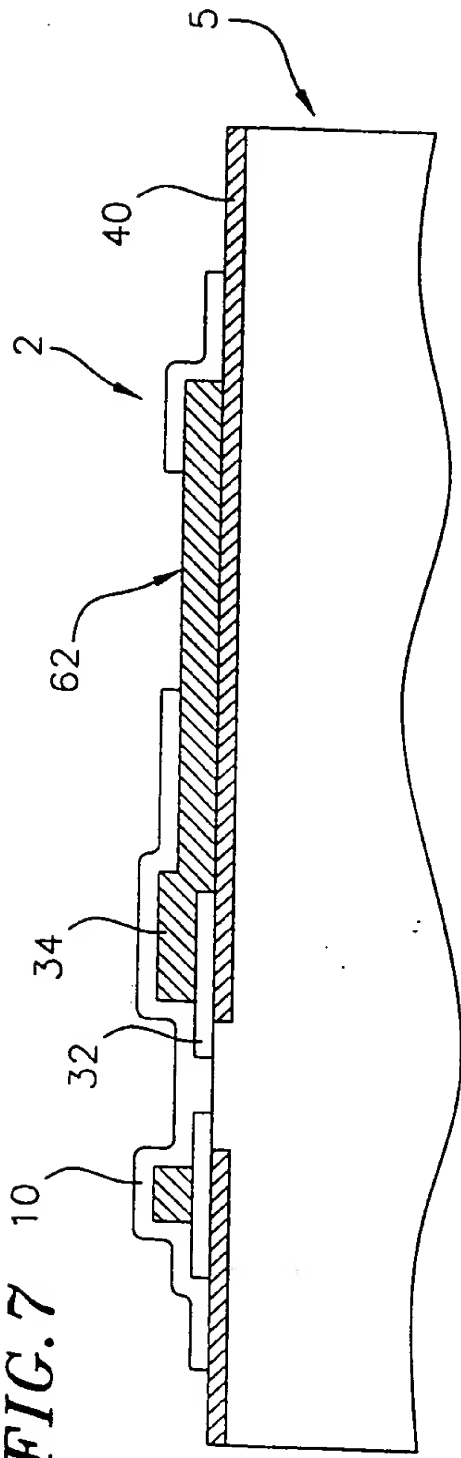


FIG. 8

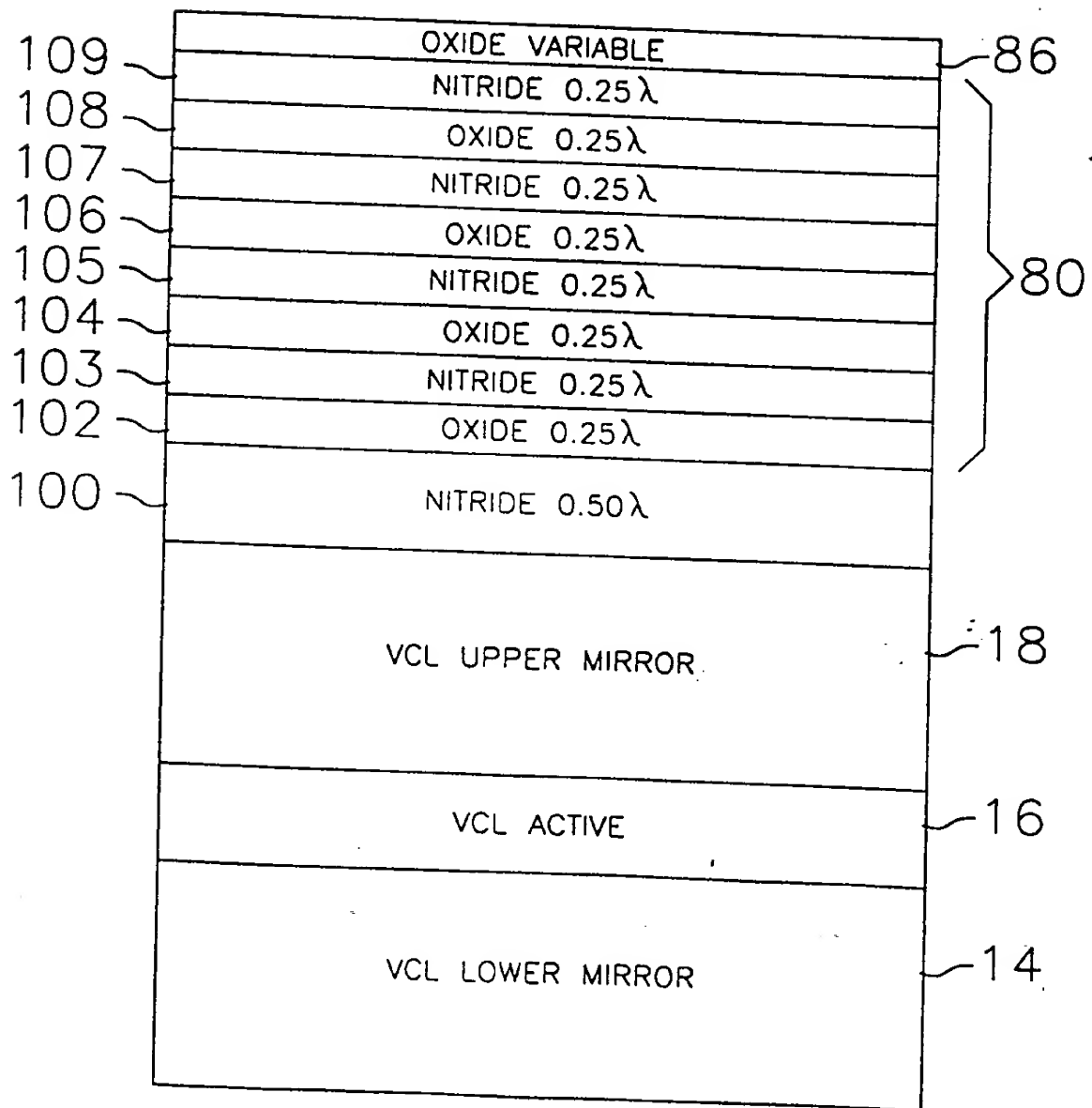
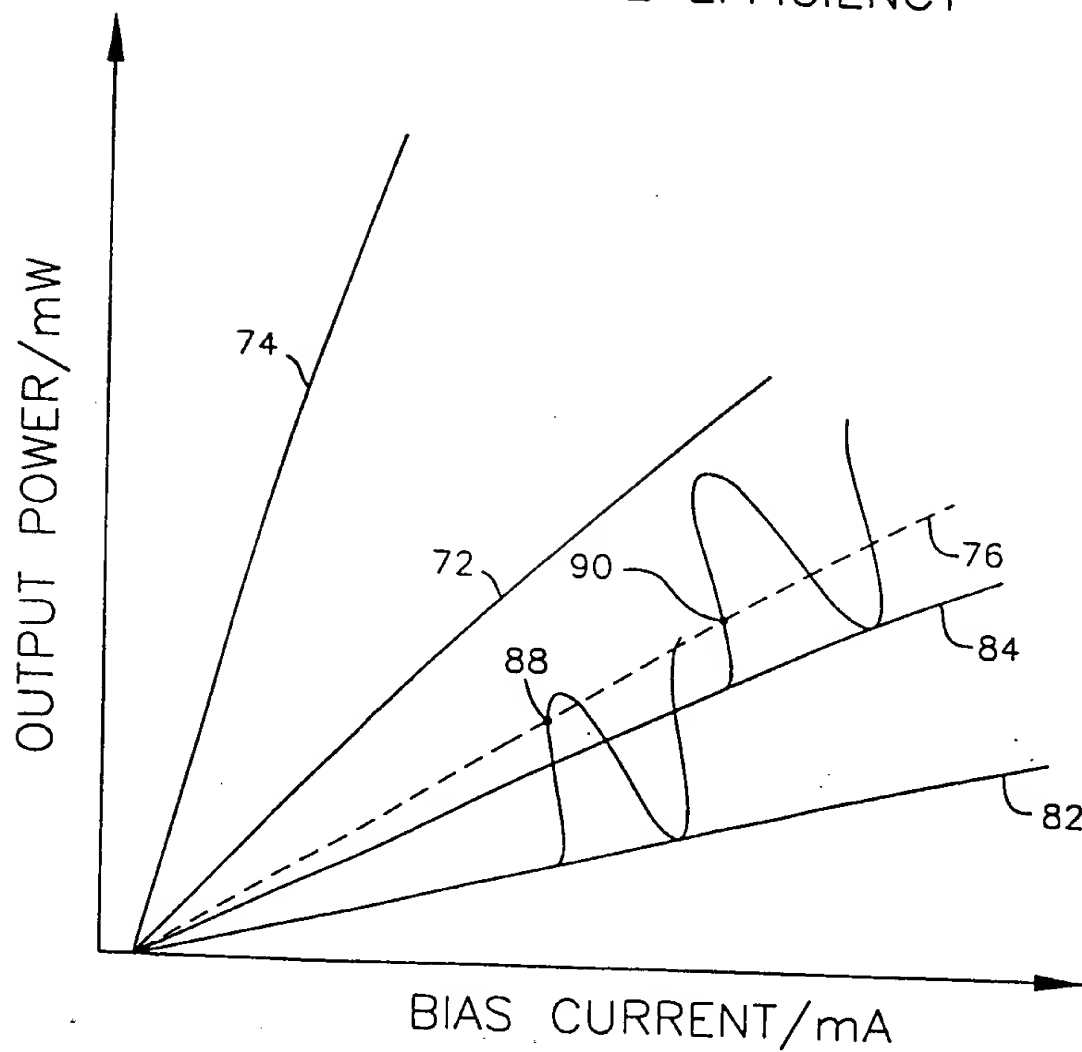


FIG. 9

LASER SLOPE EFFICIENCY



004220 6295560

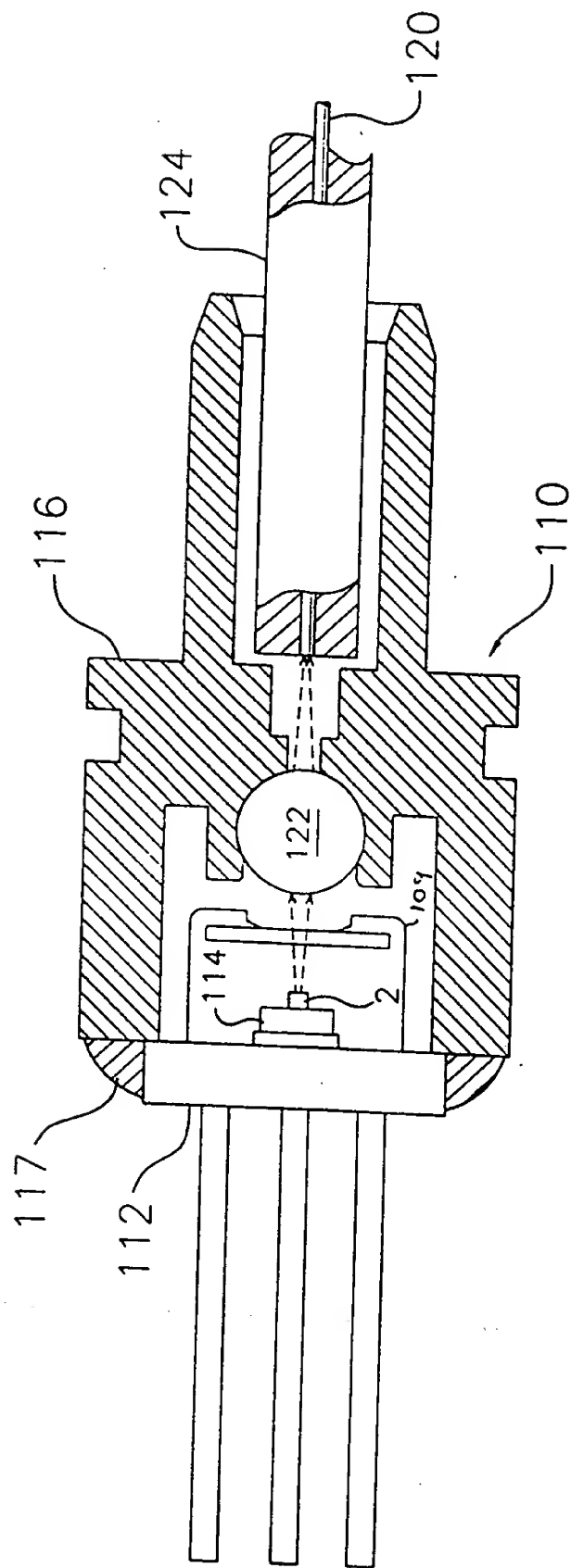


FIG. 10

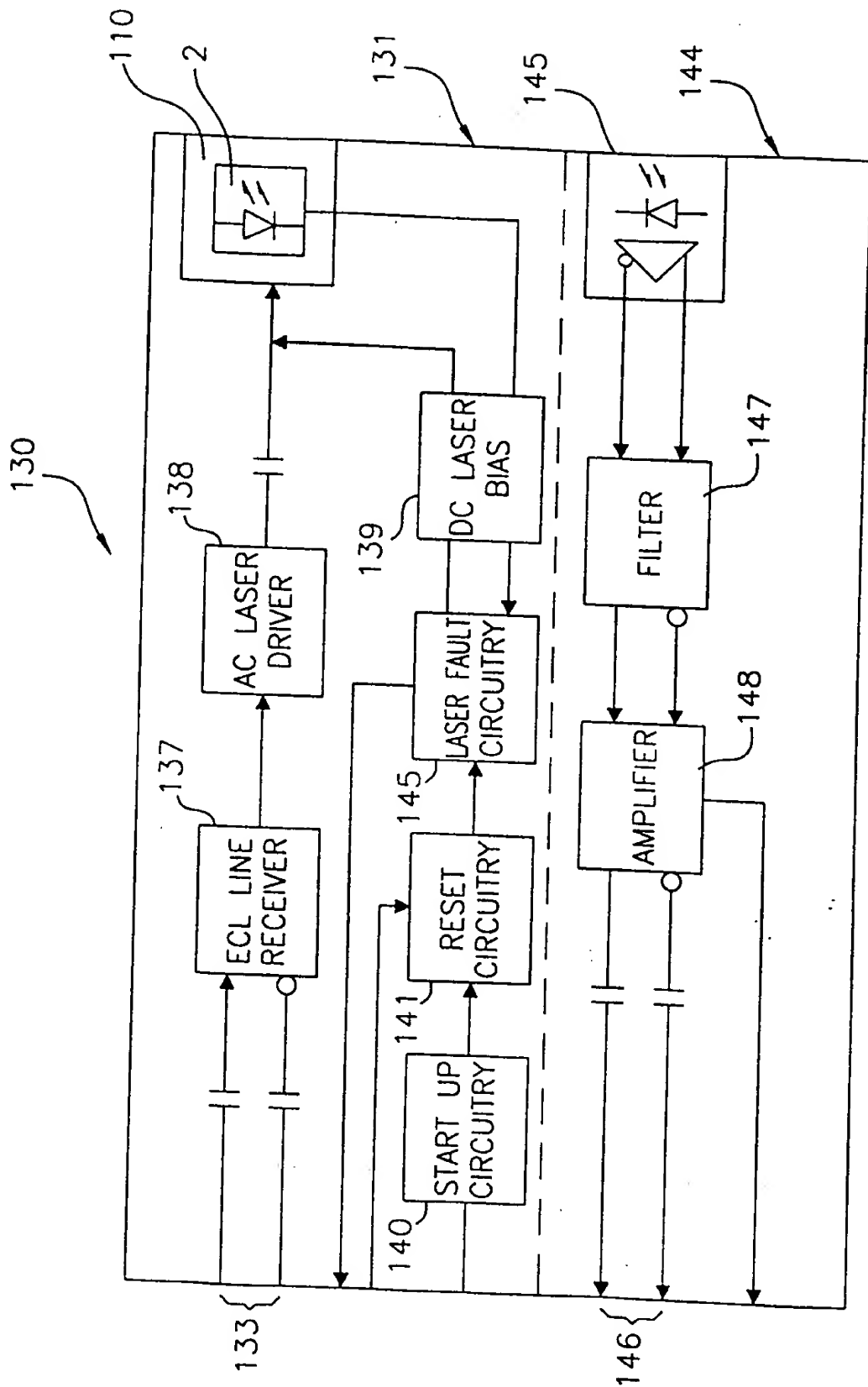


FIG. 11

VCSEL PACKAGE DOTED PLASTIC ENCAPSULATION W/ ANGLED WINDOW

plastic encapsulation replaces for TOS6 package without impacting other packaging config

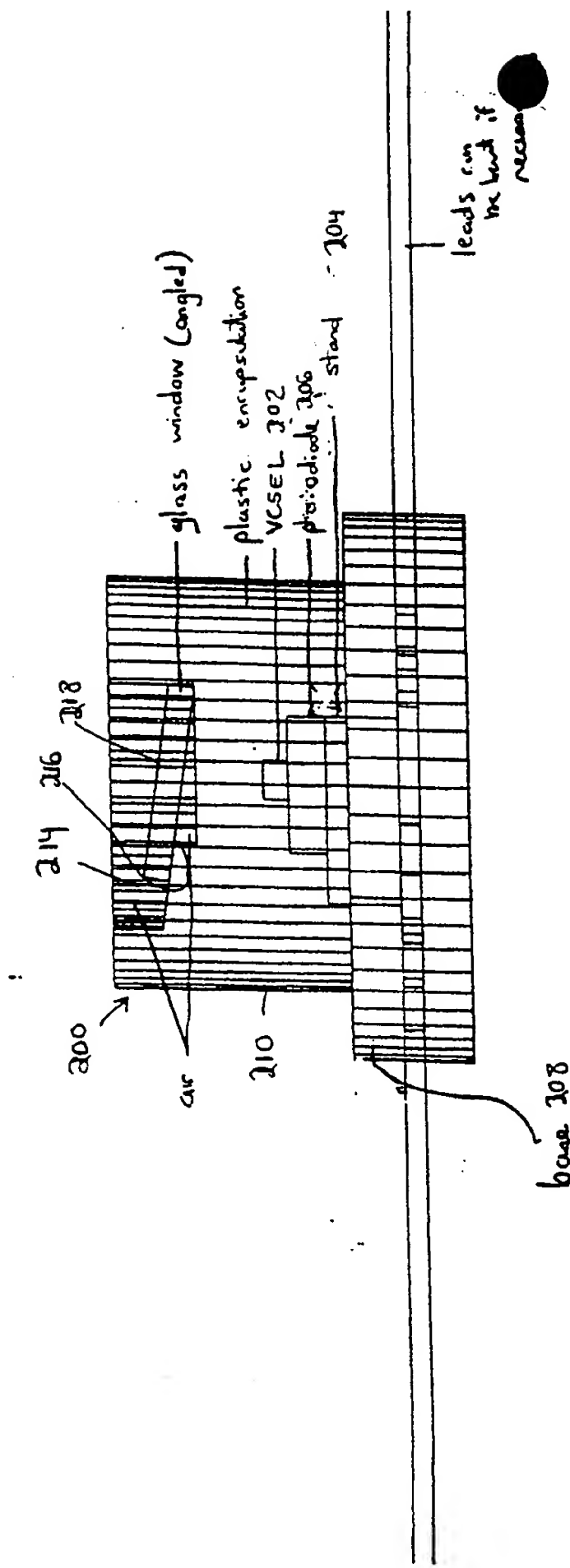
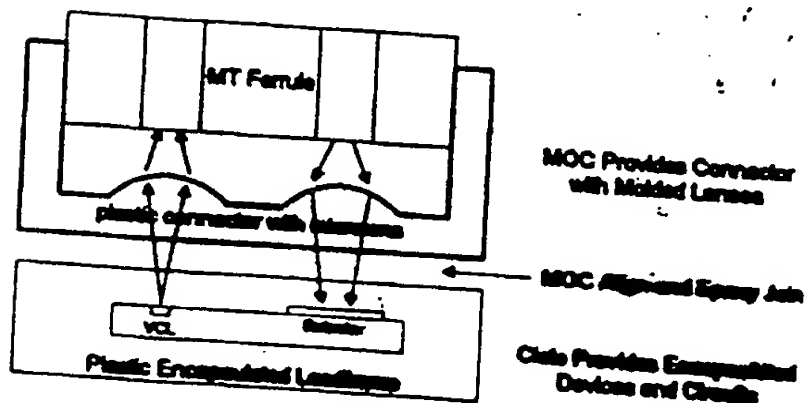


FIG. 12

FIG. 13

Small Form Factor Concept

PLASTIC ENCAPSULATED



004260" 6295660

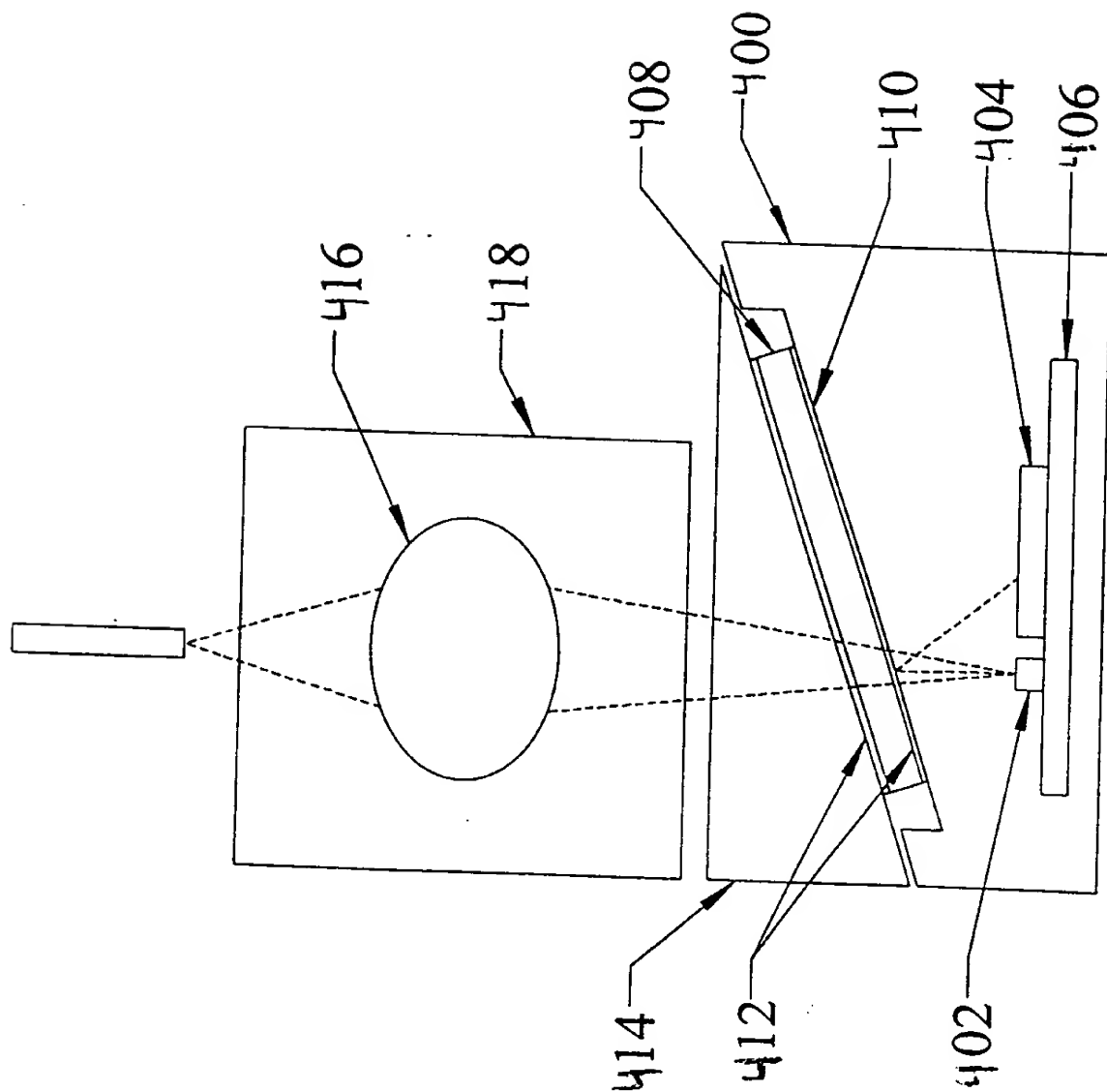


FIG. 14

FIG. 15

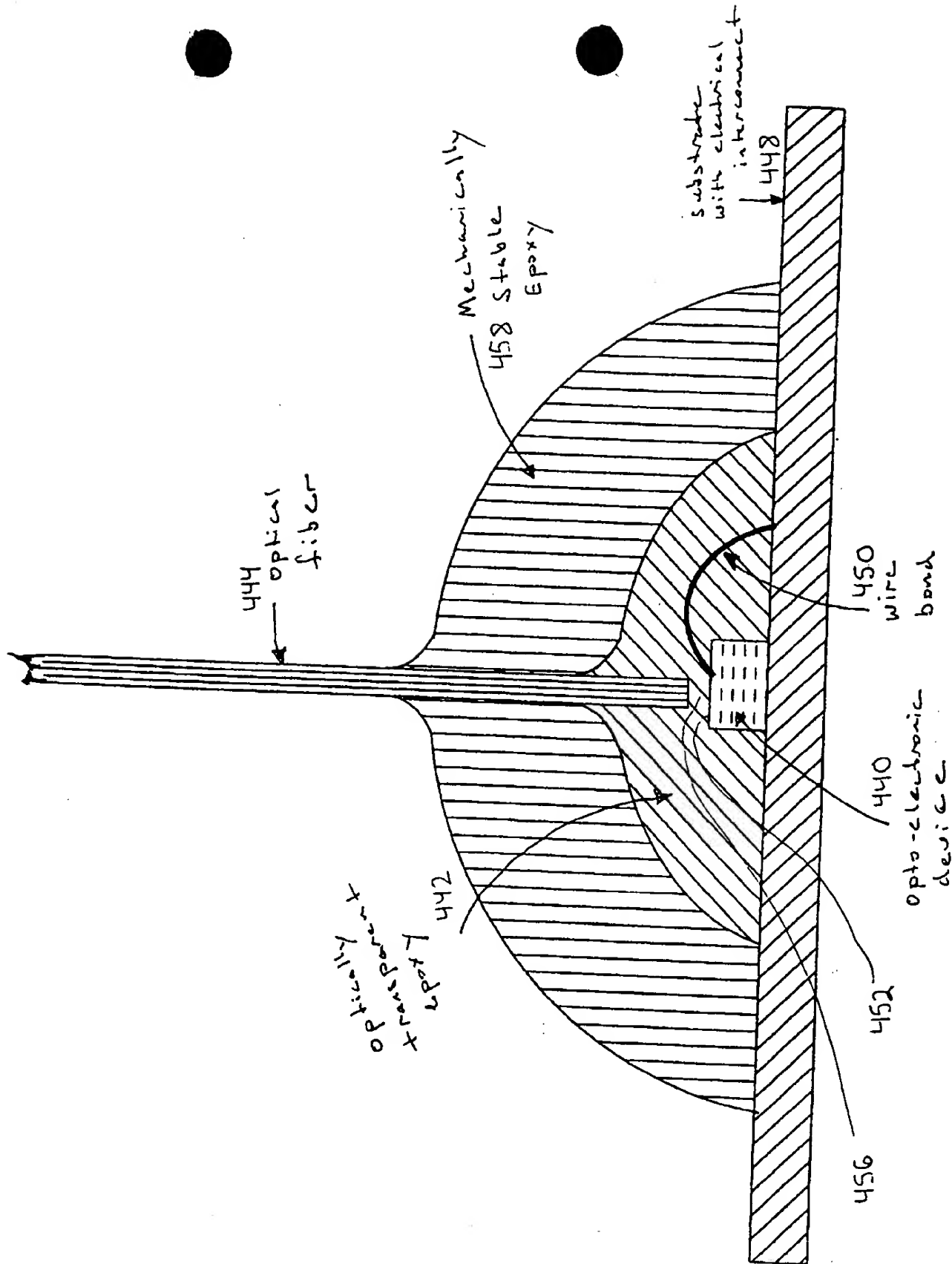
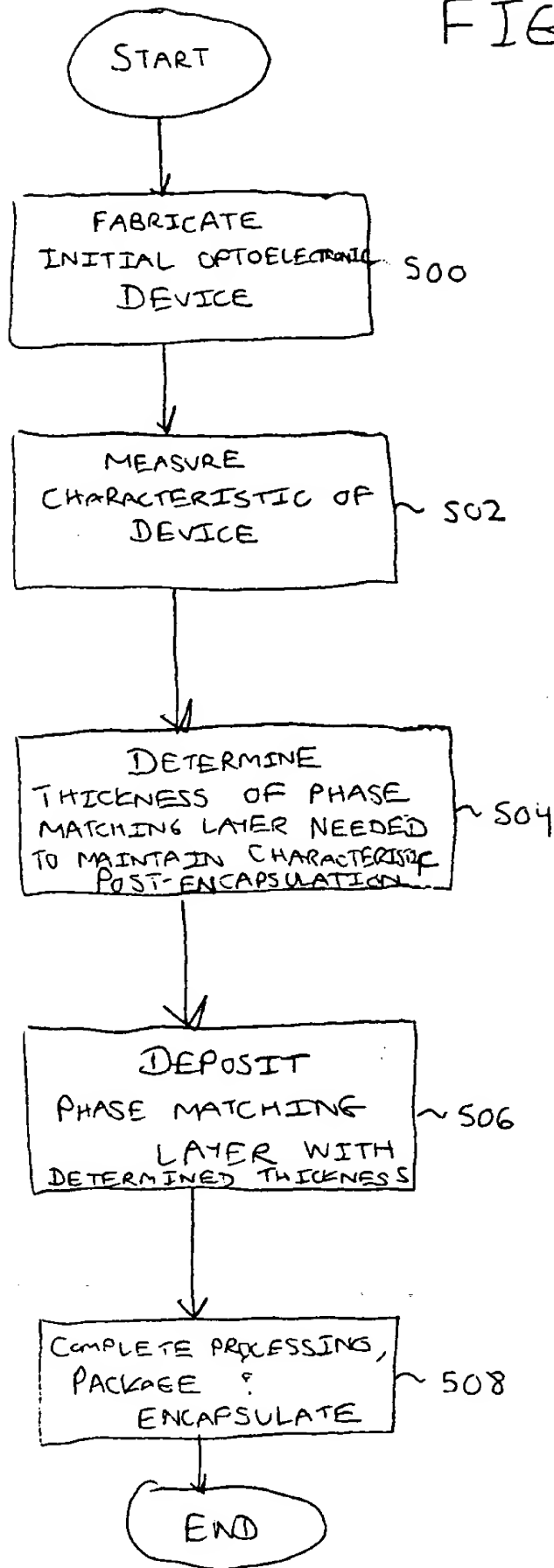


FIG. 16



0042E0" 6295E560

VCSEL structure	Oxide Phase Match Thickness (Å)	Transmission in air (%)	Transmission in plastic (%)
4 periods +	0	0.017	0.025
4 periods +	200	0.017	0.025
4 periods +	400	0.018	0.025
4 periods +	600	0.020	0.024
4 periods +	800	0.023	0.024
4 periods +	840	0.024	0.024
4 periods +	1000	0.027	0.024
4 periods +	1200	0.032	0.023
4 periods +	1400	0.034	0.023

FIG. 17

0042E0" 6295E60

layer

air or
encapsulant

$$T = 1 - R$$

1	phase matching
2	nitride 0.25λ
3	oxide 0.25λ
4	nitride 0.25λ
5	oxide 0.25λ
6	nitride 0.25λ
7	oxide 0.25λ
8	nitride variable
9	oxide 0.25λ
10	nitride 0.50λ
	VCSEL upper mirror
	VCSEL active
	VCSEL lower mirror

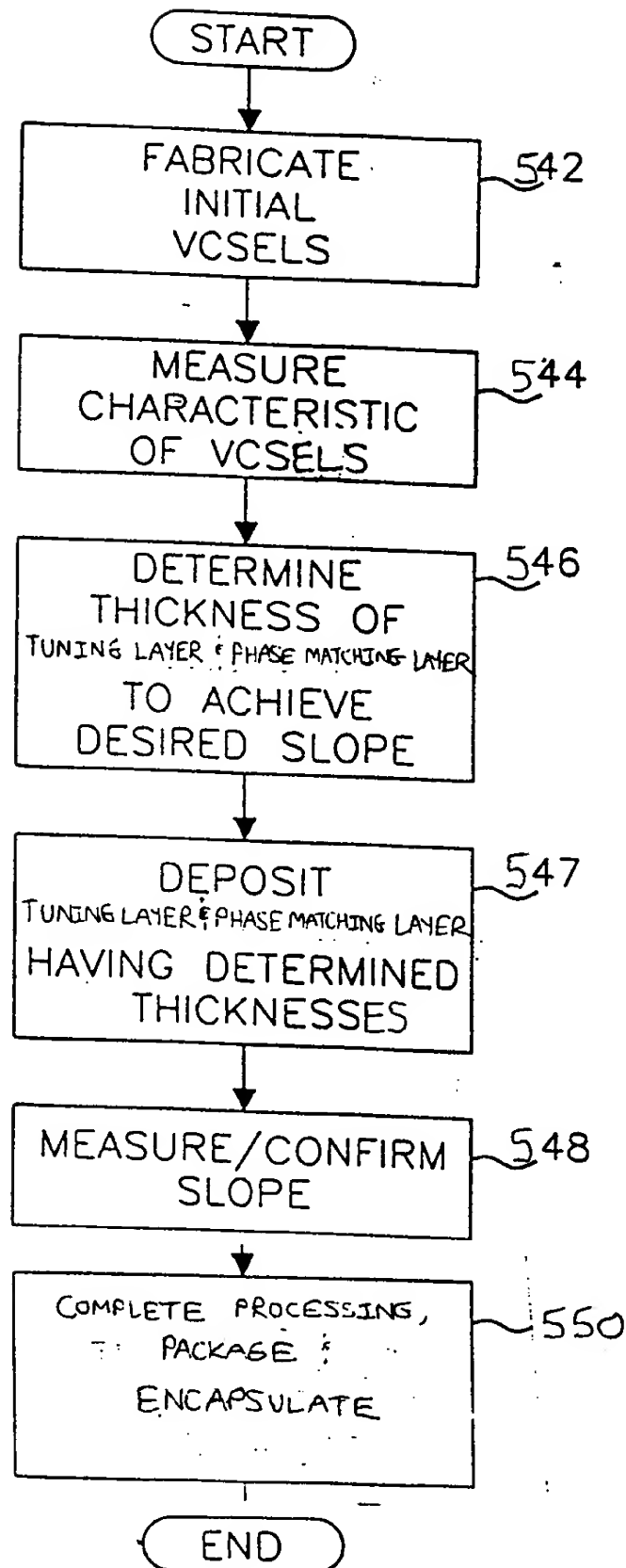
FIG. 18

Tuning Layer Thickness (layer 8)	Phase Match Thickness (layer 1)	Transmission in air or plastic	Loss	Optical Efficiency	Scaled
as grown	No mirror	0.256	0.3	0.460	1
1062	840	0.024	0.3	0.074	0.161
850	1050	0.025	0.3	0.077	0.167
637	1300	0.029	0.3	0.088	0.191
425	1550	0.036	0.3	0.107	0.233
212	1930	0.042	0.3	0.123	0.267
0	2330	0.045	0.3	0.130	0.283

FIG. 19

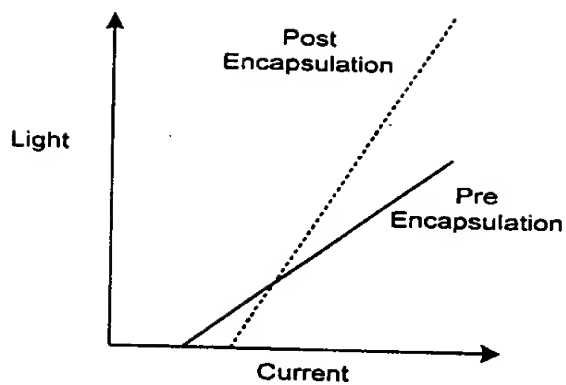
004220" 6295E560

FIG. 20



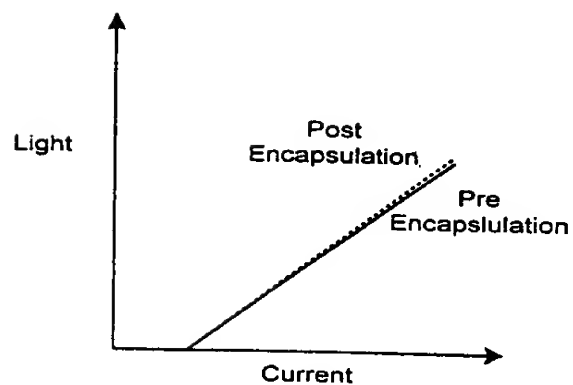
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Standard VCSEL Laser
without invention

FIG. 21



VCSEL Laser according to the
invention

FIG. 21A